Mine Health and Safety Council

MHSC

NIHL Prevention Programme – Track C Training and Awareness and HPD selection

Draft Final Report

RM Franz
AL Edwards

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Abbreviations and nomenclature

HCP	hearing conservation programme
HPD	hearing protection device
H & S	health and safety
MHSC	Mine Health and Safety Council
NIHL	noise-induced hearing loss
SIMRAC	Safety in Mines Research Advisory Committee
GEN 011	SIMRAC Project GEN 011
CSIR	Council for Scientific and Industrial Research
CD	Compact disc
DVD	digital video disk/digital versatile disc
PLH	Percentage Loss of hearing

Executive summary

Despite ongoing efforts to improve the effectiveness of mine hearing conservation programmes (HCPs), noise-induced hearing loss (NIHL) continues to cost the South African mining industry a great deal of money and to cause loss of quality of life for the victims of NIHL.

The Mine Health and Safety Council (MHSC) Prevention of NIHL programme initiated Track C (SIM 050501) to address the needs of stakeholders in the mining industry when implementing HCPs.

Educational, motivational and training materials

The educational, motivational and training materials produced by GEN 011 (Franz et al.,1997) for NIHL prevention in the form of video programmes, booklets and guidelines for trainers formed the basis of the project, which aimed to evaluate the materials and make recommendations for the updating the materials.

Purchase records from the distribution of GEN 011 materials were analysed and an interview questionnaire was developed as a tool for gathering data in telephonic and personal interviews. The results indicated that, during the ten years since the development of the GEN 011 materials, only 52 training packages had been purchased and only five mines were still using the materials purchased; six had used them previously but no longer used them; and eight reported never having used them. The most popular component product of GEN 011 were the booklets, with English being the most popular choice of language medium, and then Fanakalo, followed by the Zulu booklets.

Host mines were identified, where focus group and individual interviews were held with mine employees from coal, gold and platinum mines.

Criteria used in a questionnaire for evaluating the educational, awareness and motivational materials were:

- ***Accessibility*** of the material in terms of different mother–tongue languages, different cultural practices, and varying levels of sophistication and literacy;
- ***Motivational value*** of the material for mineworkers to protect themselves from NIHL by explaining the risks and making the consequences of noise exposure clear;

- ***Relevance*** of the material to individual needs at different levels of authority and in various workplaces;
- ***Enabling value*** of the material to inform and instruct clearly on the correct and effective use of hearing protection devices (HPDs) and HCP practices; and
- ***Technical quality*** of the materials with regard to image quality, sound quality, and availability of material.

The perceived appropriateness, relevance and effectiveness of the training booklets from GEN 011 were measured at all employee levels by means of discussions in focus groups and personal interviews. Reactions to the video were assessed by means of a questionnaire. Suggestions were solicited to improve the video and the booklet.

Recommendations were made to the MHSC.

Recommendations relating to the video were as follows:

- The video should be distributed in DVD format only
- The gold-platinum and coal versions should be consolidated into a single programme
- The sound track (English and Zulu) should be re-dubbed to improve the sound quality. This will entail replacing many of the narrator on-camera scenes with scenes/footage that have off-camera narration.
- Improved access by different language groups and for use in different acoustical environments should be provided
- Scenes/footage with female mineworkers should be included to improve relevance
- The old music should be updated to be more contemporary music
- Volume 2 of *Guidelines for Trainers* should be revised to correspond with the updated video programme
- An audio demonstration of hearing loss and its impact on speech intelligibility should be included into the video.

Recommendations for updating the HPD booklet were as follows:

- Panels with female mineworkers should be included
- Some of the pictures of HPD types should be revised to ensure that they are representative of what is available and in common use

Recommendations regarding the distribution and use of the materials were as follows:

- More effective promotion to raise practitioners' awareness of the materials' availability
- More effective and broad-based means of distribution
- Updated materials should be made available for incorporation into mines' computer-based e-learning programmes.

The revised materials were evaluated at the same host mines as the first evaluation, using focus groups and the project team expert focus group. The same criteria were used to evaluate the changes to the materials.

The findings of the evaluations conducted at gold, coal and platinum mines indicated that the updated awareness and training materials, particularly the video programme, are more effective than were the original GEN 011 materials.

HPD selection tables

Gen 011 (Franz et al., 1997) measured the noise exposure levels of employees in different occupations in the coal, gold and platinum mining industry. HPD selection tables were developed on the basis of the noise exposure levels of the occupations sampled. The HPDs that were listed in the selection tables were those available in South Africa in the mid-1990s. In order to make the NIHL prevention tools available to the mining industry relevant and up-to-date, the MHSC included the updating of this valuable HPD selection tool as part of the SIM 050501 Prevention of NIHL programme.

The research team used the web-based National Institute of Occupational Safety and Health (NIOSH) tool as the basis of the updating process. Information about all the HPDs on the NIOSH website that are available in South Africa were collected and used to develop an updated list of HPDs for 2009. The frequency-specific attenuation data supplied by the HPD manufacturers and suppliers was incorporated into the HPD selection tables available from GEN 011. The HPD selection tables were further updated by formulating the tables into a user-friendly Excel®-based version of a selection table for each occupation. The HPD selection tables indicate:

- the expected noise exposure levels as measured by GEN 011
- the average effective attenuation for each HPD available

- whether the resultant average noise exposure with HPDs will result in noise exposure levels of above the Occupational Exposure Level (OEL)
- if the average expected attenuation is likely to interfere with speech communication as a result of overprotection by the HPD.

The tool includes:

- A list of 97 HPDs available in South Africa in 2009, with tables indicating the effective attenuation that can be expected from each HPD at each central frequency;
- Guidelines for the use of the HPD selection tables;
- Coal mining occupations in surface workshops and general coal mining; and
- Gold and platinum mining occupations, which include the surface workshops, surface plants and conventional or mechanised mining.

The SIM 05 05 01 Track C project has provided the industry with updated awareness, education and motivational materials as well as up-to-date HPD selection tools. However, the final recommendation in the interim report to the MHSC is still relevant viz. that effective promotion to raise practitioners' awareness of the materials' availability is needed and that an effective means of distribution is essential to ensure that the updated materials are implemented.

To achieve wide distribution and use of the materials, it is recommended that workshops be held at all major mining centres. The workshops should involve training and occupational health personnel from all commodities. It is also recommended that copies of the SIM 05 05 01 materials be made available to all workshop participants. To this end various of promoting the materials could be considered e.g. industry-specific magazines and journals and MHSC website.

1. Introduction and background

Despite ongoing efforts to improve the effectiveness of mine hearing conservation programmes (HCPs), noise-induced hearing loss (NIHL) has cost the South African mining industry in excess of R890 million in compensation claims alone from 1997 to 2007 (Kritzinger, 2009) and this does not take into account the impacts on productivity/profitability and mineworkers' quality of life. Previous SIMRAC projects dealing with occupational noise have included GEN 011 (1997) and more recently, Health 806 (Franz, 2005), which incorporated guidelines for best practice in the implementation and management of mine HCPs. Even with initiatives to reduce noise emission through engineering measures, personal protection will continue to be an important means of limiting NIHL risks to mineworkers. Both of the abovementioned projects emphasised the need to improve mineworkers' knowledge of NIHL and awareness of noise as a hazard, as well as to improve their motivation to comply with safe work practices that include the correct use of hearing protection devices (HPD). With these needs in mind, GEN 011 produced the following materials:

- A video programme in English and Zulu for coal and gold and platinum mines:
    1) Module 1: Educational/Motivational (15 minutes long), which conveyed the message that loud noise is hazardous and illustrated the potential consequences of exposure;
    2) Module 2: HPD training (10 minutes long), which reinforced educational and motivational aspects from Module 1 and demonstrated the correct use and care of various types of hearing protection devices (HPDs);
- Handouts for trainees in the form of 16-page A-5 self-cover booklets illustrating the risks of excessive noise exposure, as well as the correct use and care of HPDs, produced in English, Zulu and Fanakalo;
- Four volumes of guidelines for trainers, comprising:
    1) A script for induction talks on the noise hazard, with a demonstration of the benefits of using HPDs in noisy areas and their correct use and care, with four supporting overhead transparencies;
    2) Use of the training videos, with the scripts for Modules 1 and 2 appended;
    3) Use of the handout booklet, with a reproduction of the booklet appended; and

4) Suggestions for ways of responding to reasons or excuses commonly given by mineworkers who neglect to use HPDs.

Medical surveillance findings indicate continued shifts in percentage loss of hearing (PLH) from baseline (Begley, 2006), despite the Mine Health and Safety Council (MHSC) milestone to eliminate NIHL, which can be expected to result in large numbers of mineworkers being compensated for NIHL in the near future.

Given the need to enhance the effectiveness of awareness and training materials and mine personal protection strategies while more systematic control measures were being implemented, SIM 05 05 01 Track C had as its primary outputs

1. multimedia training, educational, awareness and motivational materials for the prevention/elimination of noise-induced hearing loss (NIHL), aimed at all levels of mine employees, particularly mineworkers.
2. Updated HPD selection tables.

These two primary outputs comprised the following enabling outputs:

- Assessment of educational, awareness and motivational materials developed for GEN 011;
- Identification and evaluation of other materials available from local and international sources;
- Interim report on criteria and recommendations for the updating and enhancement of educational, awareness and motivational materials for use in mine HCPs;
- Educational, awareness and motivational materials updated in accordance with the assessment of their usefulness and effectiveness; and
- Compilation of frequency-specific attenuation data for all currently available HPDs (with manufacturers' and suppliers' contact details) for noise associated with various occupations, workplaces and machinery in the mining industry.

The present report incorporates the results previously presented in the interim report on the assessment of the GEN 011 materials, with recommendations for updating those materials, and the findings of evaluations of the revised materials. The second primary output of the project, the updating of the HPD selection tables, is reported in Section 8 of this report. The updated awareness and educational materials, together with guidelines for use, and the updated HPD selection tables, with guidelines for their use, have been compiled on three DVDs and one CDs along with this report..

2. Methodology

The methods used to achieve are described in the sub-sections that follow.

2.1 Assessment of materials from GEN 011

The first enabling output of the current project was an assessment of the educational, motivational, awareness and training materials developed for GEN 011, in terms of their effectiveness and usefulness. Accordingly, certain activities were conducted, as outlined below.

2.1.1 Delivery notes review

When GEN 011 was developed, the distribution of the material to the mining industry and potential users was conducted by CSIR (Miningtek at the time), which had been the primary research agency for the project. Orders and delivery notes for the materials were analysed for commodity, company, contact information, types of materials purchased, and number of training packages purchased.

2.1.2 Evaluation by purchasers

The research team developed a questionnaire (see Appendix A-1.1) as a tool to gather data. The focus of the questions was on:

- The frequency of use of the various materials from GEN 011;
- The use of alternative commercially available materials;
- Suggestions for improvement of the GEN 011 materials
- The degree of relevance of the materials with regard to various mining occupations; and
- The identification of potential host mines where focus groups could be convened to evaluate the Gen 011 materials.

Officials at each organisation that had purchased the materials were contacted telephonically. Where possible, personal interviews were arranged with the relevant officials. Only purchasers of the GEN 011 materials in the mining sector were contacted to ensure relevant data gathering within the scope of the project. The questionnaire was used as a basis for telephonic discussions and personal interviews and, when information was obtained that was

not in direct answer to the questionnaire, the issues raised were noted. Results were entered into Excel® spreadsheets and analysed using descriptive methods.

2.1.3 Focus group evaluations

The assistance of three mines (one each of gold, coal and platinum) was secured, for the purpose of conducting focus groups and employee interviews to evaluate the GEN 011 materials.

When potential host mines were identified, the sub-contracted industrial sociologist who was to convene the focus groups was informed and arrangements for on-mine evaluations were made. Letters were sent to the relevant mine manager and a PowerPoint® presentation (Appendices A-1.2 and A-1.3) were compiled to inform the management of the potential host mines of the project objectives and the intended evaluation process.

The PowerPoint® information session included an explanation of the purpose of the focus groups, a commitment to confidentiality, and an outline of the requirements for the focus groups. The objective of conducting the focus groups and semi-structured interviews was to collect data on the perceptions and views of all levels of mine personnel at the three host mines that would provide views from employees for the assessment, evaluation and improvement of existing materials intended to limit the incidence of NIHL.

Project team members then met with prospective champions at the mines to explain the intended approach to evaluating the GEN 011 materials. The scope, objectives and aims of the project were presented and mine representatives were given an opportunity to raise questions and express any concerns that they had. The project team emphasised that the purpose of work to be conducted at host mines was to evaluate the GEN 011 materials, and not to assess mines' training programmes or HCPs.

Given the need to work within the constraints imposed by the labour-intensive nature of mining operations and stringent work schedules, a flexible research method was employed in conducting focus groups at host mines' training centres. In instances where the sample of employees at the training centres to participate in focus groups did not include a variety of participants at all employee levels, individual interviews were conducted with underground employees and management personnel.

The effective assessment of the educational, awareness and motivational materials developed for GEN 011 required a set of criteria that would facilitate equitable assessment and comparison. The evaluation also required awareness of the necessary educational and

motivational outcomes for a successful HCP. The research team agreed on the following five criteria on the basis of information sourced from the team's respective expertise in psychological, sociological, educational and hearing conservation experience and knowledge:

- ***Accessibility*** of the material in terms of different mother–tongue languages and cultural practices and varying levels of sophistication and literacy;
- ***Motivational value*** of the material to encourage mineworkers to protect themselves against NIHL by explaining the risks and the consequences of noise exposure;
- ***Relevance*** of the materials to individuals' needs at different levels in the organisation and in various workplaces;
- ***Enabling value*** of the material to inform and instruct clearly on the correct and effective use of HPDs and other aspects of the HCP; and
- ***Technical quality*** of the materials with regard to image quality, sound quality, and availability.

The abovementioned criteria were used to develop a questionnaire (Appendix in A-1.4) to be used for assessing the awareness and motivational materials developed for GEN 011 in the following ways:

- In on-mine focus groups and interviews that involved various levels of mine employees; and
- An "expert" focus group consisting of the project team members.

The GEN 011 video "*To Hear or Not to Hear: the Choice is Yours"* was shown to trainees at the mine training centres and the questionnaire was administered immediately after the screening. Mine training personnel provided a question-by-question translation of the questionnaire where the participants did not understand or read English. Where the focus group members were literate in English they completed the questionnaires independently.

A total of twelve focus groups were conducted at the three host mines.

Reactions to the video were assessed with a group of 66 employees at the platinum mine where the video was routinely included in the induction training programme. The employees consisted mainly of contractors.

Focus groups at the gold mine consisted of 37 permanent employees. Some of the employees were supervisors up to the level of shift overseer. Focus groups at the coal mine comprised 41 employees who were attending induction training.

Focus groups and individual interviews included the following occupations: human resource manager, production manager, section manager, health and Safety manager, training officer, machine/equipment operator, production team member, mine overseer, shift supervisor, team supervisor, contractor supervisor and artisan.

The questionnaire took the form of 24 declarative statements. Focus group members were asked to indicate the extent of their agreement or disagreement with the statements on a Likert scale (Likert, 1932). The five criteria for evaluating the materials: accessibility, motivational value, relevance to the target audience, enabling potential, and technical quality formed the basis for the questionnaire and the issues that were raised by the facilitator during focus group discussions.

The results of focus group discussions and employees' responses to the questionnaire were entered into Excel® spreadsheets and analysed, using the SPSS 14 for Windows® package.

2.2 Identification/evaluation of materials available locally and internationally

A review of the literature and an Internet search for local and international sources of multimedia training, and educational awareness and motivational materials that were suitable for industrial HCPs was conducted. Searches for reviews/evaluations/critiques of the identified materials were included in the process either electronically or by means of personal communication with practitioners in the field of NIHL prevention education.

Secondly, where applicable, the activities included determining costs of and copyright limitations on the distribution and use of materials identified. Where possible copies of video programmes and PowerPoint® presentations that had been identified as potentially useful in mine HCPs were obtained and reviewed. It was intended that materials found to be appropriate and relevant would be evaluated by the on-mine focus groups, but the materials reviewed were found to be generally unsuitable for South African mineworkers. Most of the materials reviewed were aimed at factory employees, with a higher level of literacy than that of most mineworkers, while other materials promoted a particular range of HPDs. Although these materials were not included in the focus group evaluations of materials, they did

provide insights into developing materials specifically aimed at meeting the informational needs of supervisory personnel, particularly line management.

3. Results

The results of the evaluations are discussed below.

3.1 Identification of purchasers of GEN 011 materials

The analysis of the results of the delivery note review indicated that, during the ten years following the development of the GEN 011 materials, only 52 training packages had been purchased. Organisations outside of the mining industry accounted for 31 per cent of sales of GEN 011 materials compared to 15 and 6 per cent for coal and platinum mines, respectively. Figure 3.1a indicates the number of training packages purchased by gold, coal and platinum mines.

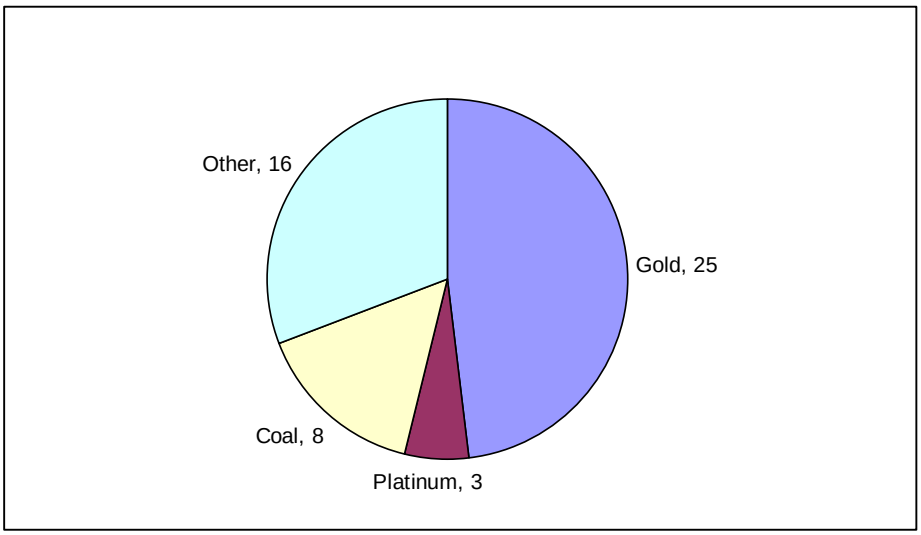

Figure 3.1a Purchase of GEN 011 training materials by commodity

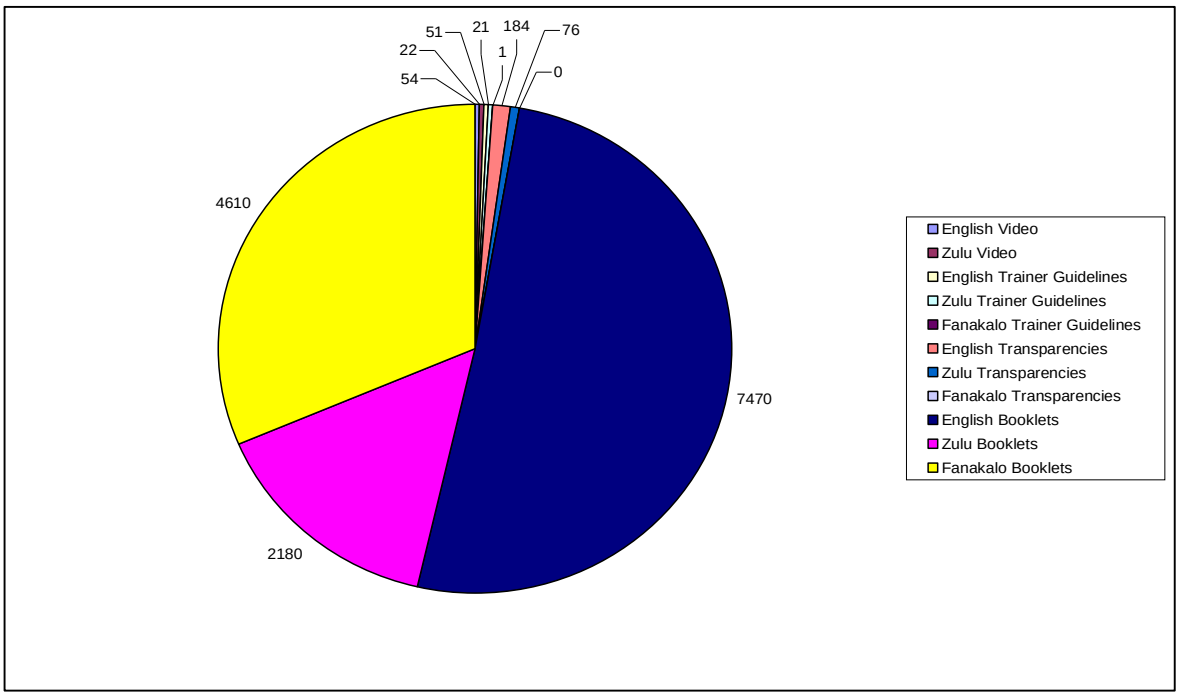

Figure 3.1b Number and type of GEN 011 training materials purchased

A number of orders placed within the various commodity groups were often placed by the same individual, which meant that only one contact person may have ordered numerous sets of the materials for one company, with the intention of supplying many shafts and training centres within the organisation. This limited the number of opportunities the research team had for interviewing the purchasers of the materials. It was also found that the order originator may have purchased the materials and then moved to a different company, either within the original commodity or a different commodity, and then ordered the materials for their next place of employment. This again meant that the number of order originators to be interviewed was limited. These findings have implications for improved quality and relevance of record-keeping standards when projects such GEN 011 are carried out.

The various commodities that were identified as purchasers of the materials were gold mines, platinum mines, coal mines and then other industries such as timber producers, fisheries, universities and government departments. The distribution of the purchases across the various industries is depicted in Figure 3.1b above. The number of packages purchased by gold mines was 25; three packages were purchased by platinum mines, eight by coal mines and collieries, and 16 by the other industries and institutions.

Figure 3.1b indicates that the most popular component product of GEN 011 was the booklets, with English being the most popular choice and then Fanakalo, followed by the Zulu booklets. More than twice as many copies of the English version (54) of the video as the Zulu version (22) were ordered, while a similar ratio was exhibited with regard to the English trainer guidelines (51) in comparison to the Zulu guidelines (21). Only one copy of the Fanakalo guidelines was ordered. It is assumed that the transparencies (intended for training purposes) were to be used in conjunction with the trainer guidelines and so it is not surprising that 184 English transparencies were ordered while only 76 Zulu versions and one Fanakalo version were ordered.

3.2 Interviews with purchasers of GEN 011 materials

The objective of this aspect of the evaluation was to obtain feedback regarding the usefulness and effectiveness of materials from GEN 011, considering ease-of-use, relevance to mine employees from various levels and occupational groupings, and the impact of the materials on employee behaviour, in order to determine requirements for updating and enhancing the materials. The interviews also aimed at identifying willing host mines where focus groups could be held.

Among the mining companies, organisations and institutions that purchased the materials (a total of 52 packages), it was only possible to contact 12 mining companies (representing the various commodities and organisations within each commodity) that were familiar with the materials and able to provide some feedback. The responses of the 12 operations in a position to provide feedback are shown in Figure 3.2. Of these operations, five were still using the materials purchased, six had used them previously but no longer used them, and eight reported never having used them.

The majority of respondents reported never having used the materials once they had been purchased, which was a further motivating factor for identifying the user needs in terms of the materials and ways in which the materials could be improved on.

Information regarding the use of GEN 011 materials included one report that the video had been converted to DVD format and was being played in the waiting area of the mine's Occupational Health Centre on an ongoing basis. A respondent from one gold mine indicated that the training booklets had been enthusiastically received by employees, but that their use had been discontinued because the HPDs depicted in the drawings were outdated. A representative of one mine reported that all of the GEN 011 materials, including the Fanakalo version of the training booklet, were still in regular use. With regard to the videos, reasons for

non-use given by various respondents included breakage, theft or redeployment of equipment used to screen the materials, as well as a limited amount of time available for viewing all of the topics covered during the induction programme.

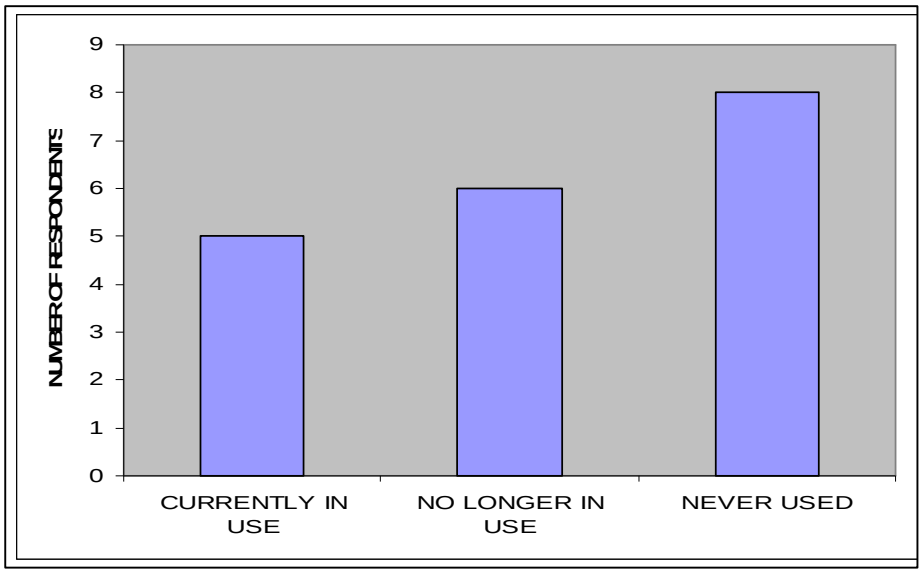

Figure 3.2 Purchasers' use of GEN 011 materials

3.3 Focus groups

Fieldwork was conducted at gold, coal and platinum mines and the perceived appropriateness, relevance and effectiveness of the GEN 011 materials were measured at all employee levels. The issues raised during discussions with focus group members centred on awareness, communication strategies, constraints to compliance.

3.3.1 Evaluation of the booklet

The GEN 011 English, Zulu and Fanakalo booklets were circulated among the focus group members. They were given a choice of which language version they preferred to read. Responses to the medium and content were measured using focus group member's answers to the questionnaire.

3.3.1.1 Receptivity to materials

Receptivity to the training booklet was high among focus group members, with most agreeing or strongly agreeing that they were willing to be informed of NIHL issues by means of the printed material. Permanent mine employees were more willing to read the printed material

than were the contractor employees, as indicated by the percentage of respondents who strongly agreed (78,8 and 48,6 per cent, respectively).

3.3.1.2 Awareness of NIHL-related issues

The general level of awareness of the noise hazard and risk of hearing loss was high among virtually all mine personnel interviewed. The interviews and focus group findings indicated that both the booklet and the video awareness and training materials from GEN 011 were very effective with regards to raising awareness of NIHL.

After reading the booklet *"Make Safe Your Ears"* in their choice of language (English, Zulu or Fanakalo), 99 per cent of focus group members judged the booklet to be effective in communicating the central message of hearing conservation, i.e. the importance of protecting one's hearing.

3.3.1.3 Suggestions solicited to improve the booklet

Regardless of the high percentage of positive comments received, focus group members and interviewees were asked to comment on possible improvements to the booklets, as indicated below.

Should the booklets be printed in colour, rather than in black-and-white?

Focus group members and interviewees generally did not regard colour printing of the booklets as necessary. However, at the platinum mine the booklets had been reproduced in colour and after gold mine focus group members were shown the colour booklets alongside the black-and-white version they preferred the booklet in colour.

Should the booklets use photographs, rather than drawings?

With the exception of one production manager, no focus group members or interviewees thought that the drawings in the booklets should be replaced with photographs of people.

Serialisation of booklet

The booklet had previously been serialised over a period of six months in the platinum mine's monthly newsletter and this was suggested by some of the interviewees as a more effective and far-reaching way to convey the booklet's message than simply distributing it to employees as they went through the training centre.

Responses with regard to interest in the booklet and literacy

There was some concern expressed, both by managers and by production operators, that wider distribution of the booklet would not necessarily result in more people actually reading it, as a result either of a lack of interest or of some workers being illiterate.

3.3.2 Evaluation of the video

More than 95 per cent of focus group members found aspects of the video to be highly effective in motivating people to wear their HPDs and all agreed or strongly agreed that the video encouraged people to use HPDs while only one per cent found it to be ineffective. The remaining four per cent were neutral in this regard.

No neutral or negative responses with regard to understanding the content of the English language video were found, despite a large number of contractor employees needing the questionnaire to be translated into Fanakalo. This suggests that the visual and audio content of the video more than adequately conveys the overall message that noise is hazardous, and that people should use HPDs to protect their hearing.

3.3.2.1 Assessing prior knowledge and awareness

Focus group members were asked to what extent the video introduced information that was new to them. Half (50 per cent) indicated that they had learned something new from the video, while approximately 40 per cent claimed that they had not been provided with any new information. The remainder were neutral in this respect.

3.3.2.2 Effectiveness of communication regarding hazards of NIHL

Some questions in the questionnaire were designed to assess the effectiveness of the video in communicating the impact of hearing loss on the individual.

Responses indicating agreement or strong agreement totalled more than 90 per cent. This attests to the video's effectiveness in demonstrating the tragedy of deafness at the individual level. After watching the video, more than 95 per cent of focus group members indicated their intention to protect their hearing.

3.3.2.3 Technical content of video

Ninety per cent of focus group members strongly agreed that HPD use and care was clearly shown in the video. Three per cent strongly disagreed that the video was effective in this respect.

3.3.2.4 Effectiveness of video in comparison with other media

Health and safety issues such as noise and NIHL risks must be recognised as being influenced by a multitude of factors and, consequently, must be treated multi-factorially. The video was found to be more effective than the booklet with 80 per cent of focus group members

3.3.2.5 NIHL consequences in the video

Focus group members frequently stated that the video's depiction of workers suffering from NIHL could have been more prominent. Tracing the lives of two workers in a "docudrama", one of whom protects himself against noise while the other fails to do so, and showing the different sets of consequences was one idea that emerged. Interviewing a hearing-impaired worker, as opposed to the one with a hearing aid, was also suggested as a possible way of illustrating the consequences of failing to protect oneself against loud noise.

A major divergence in responses by employees was noted when focus groups responded to the use of "shock tactics". One focus group comprising mainly supervisors did not find the section of the video depicting the impact of NIHL on the family as motivational as did of lower level employees. Among supervisors 43 per cent of the permanent employees registered a neutral attitude to scenes depicting the impact of NIHL on the social and family life of the victim. The cultural context of the example and cultural differences between the levels of focus group members may explain the differing views.

Despite the divergence noted in the preceding paragraph, the use of actual accounts of people suffering from NIHL and its effects on their lives, was thought to be effective by an average of 70 per cent of focus group members.

3.3.2.6 Expert focus group evaluation

The GEN 011 materials were evaluated separately by an expert focus group to facilitate the formulation of recommendations for updating the materials. The research team comprised an industrial sociologist, an ergonomist, an audiologist, and a hearing conservation specialist. The five criteria (Section 2.1.3) were used to evaluate the materials in a focus group discussion. The results are summarised in Tables 3.3.2.6a and 3.3.2.6b below.

Table 3.3.2.6a

Evaluation of GEN 011 video by expert focus group

Video					
Criterion	***Sub-criterion***	**Management**	**Line management**	**Mine workers**	**Comments**
Accessibility	*Language*	GOOD	FAIR	POOR	Second language English speakers may have difficulty. Use of subtitles will improve accessibility.
	Culture	GOOD	FAIR	POOR	
	Level of education	GOOD	FAIR	POOR	Amount of information presented and pace of presentation too fast.
Motivational	*Risks explained*	FAIR	FAIR	FAIR	More details could be included regarding audiogram.
	Consequences made clear	FAIR	FAIR	FAIR	More details could be included regarding identifying dangerous sounds.
Relevant	*To the individual*	POOR	POOR	POOR	Early pictures of hearing testing would improve relevance.
	Various workplaces	POOR	POOR	POOR	More specific reference to a workplace would improve relevance.
Enabling	*Correct use*	FAIR	FAIR	FAIR	Only certain HPDs were used in video. Broader inclusion of other types would improve enabling ability of video.
Technical quality	*Images*	POOR	POOR	POOR	Old-fashioned images. No women mentioned nor imaged.
	Sound	FAIR	FAIR	FAIR	Old-fashioned music. Venue conditions will play an important role for the sound quality of the presentation.
	Distribution	POOR	POOR	POOR	Results from the first part of the investigation and focus groups seem to indicate improved distribution/availability of the products is necessary.

Table 3.3.2.6b

Evaluation of GEN 011 booklet by expert focus group

Booklet					
Criterion	***Sub-criterion***	**Management**	**Line management**	**Mine workers**	**Comments**
Accessibility	*Language*	FAIR	FAIR	FAIR	Second language English speakers may have difficulty. Availability in other languages would improve accessibility.
	Culture	FAIR	FAIR	FAIR	
	Level of education	GOOD	GOOD	GOOD	Generic medium of presentation
Motivational	*Risks explained*	FAIR	FAIR	FAIR	More details could be included regarding audiogram.
	Consequences made clear	FAIR	FAIR	FAIR	More details could be included regarding identifying dangerous sounds.
Relevant	*To the individual*	POOR	POOR	POOR	HPDs not same as used in all mines.
	Various workplaces	POOR	POOR	POOR	More specific reference to a workplace would improve relevance. Management requires specifics regarding motivation of staff.
Enabling	*Correct use*	FAIR	FAIR	FAIR	Only certain HPDs were used in booklet. Broader inclusion of other types would improve enabling ability of booklet.
Technical quality	*Images*	FAIR	FAIR	FAIR	No women mentioned nor imaged. Colour could improve impact. Reported to be more useful than video.
	Distribution	FAIR	FAIR	FAIR	Availability at occupational health centres for waiting patients to pass the time could be useful.

The results of the fieldwork focus groups and the expert focus group were integrated with the other findings by the research team and included in the recommendations made to the MHSC regarding changes that should be made to the GEN 011 materials.

4. Conclusion from evaluations of the GEN 011 materials

A summary of the findings of the focus groups and interviews at the host mines appears to indicate that training materials need to be tailored to the specific needs of the employee in terms of his or her level in the organisation and personal experience. In such materials, the benefits of hearing conservation need foregrounding, and the hazards and dangers of NIHL need to be illustrated by way of actual life stories.

The following points about each type of training material summarise the conclusions of the research team about the perceptions of and attitudes towards the GEN 011 materials, and form the basis of the recommendations for the way forward in updating the materials.

4.1 Booklets

Conclusions regarding the booklet were as follows:

- There were no negative comments about the booklet indicating that it was found to be effective
- The information in the booklet was already included in mine training programmes whether or not as a result of GEN 011
- Booklets was serialised as part of the monthly news magazine at one mine and found to reach a broader audience. The mine planned to produce a booklet on a range of health and safety issues using a similar format to the GEN booklet indicating the usefulness of the medium
- Employees were keen to receive copies of the booklet, suggesting its acceptance.

4.2 Video

Conclusion regarding the video were as follows:

- Positive evaluations of the video's effectiveness indicate that the updated programme should use a similar approach but with better sound quality and additional languages to improve accessibility
- The updated video should include interviews/case studies to convey the impact of NIHL

- The updated video should emphasize not only the impact of NIHL but include the benefits of hearing conservation
- The overhead-projector transparencies were favourably received and should be included in the updated guidelines for trainers
- The video was rated as the most effective medium in comparison with the booklet and lectures.

5. Identification/evaluation of materials available locally and internationally

The objective of the second enabling output of the project was the identification and evaluation of other materials available from local and international sources with a view to identifying information that would inform recommendations for the improvement of GEN 011 materials. The activity necessary to reach this objective was a review of the literature and Internet searches for local and international sources of multimedia training, educational awareness and motivational materials that are suitable for industrial hearing conservation programmes. The activity included a search for reviews, evaluations, and critiques of such materials.

Extensive Internet searches and literature reviews were conducted to identify alternative awareness and motivational materials for industrial hearing conservation purposes and, more specifically, for the mining industry. Searches were aimed at multimedia training materials. The materials identified and evaluated are discussed below.

5.1 PowerPoint® presentation

NIHL and hearing conservation session: Introduction to NIHL

Author: R.J. Matetic, CDC NIOSH Mining hearing loss prevention workshop, Pittsburgh Research Laboratory

The NIOSH hearing loss prevention research group developed this 17-page PowerPoint® presentation available in an open source format on the Internet.

Some useful information in this source not noted in the GEN 011 material is the inclusion of some statistics, graphically represented, about mining and NIHL. The presentation also explores the reasons that noise is bad for our health and the effects of loud noise over the length of a career in an easily understandable way for all levels of education. The trainee is

asked to identify where hazardous noise comes from and when is “Loud too Loud”. Hearing loss types are discussed and normal and abnormal hearing is explained through the use of an audiogram. Similarities to GEN 011 are: the inclusion of how noise damages outer hair cells, the use of electron-microscope pictures of normal and damaged hair cells, and an explanation of typical noise levels in the environment.

The presentation provides basic hearing conservation principles by answering the question “What can you do about it?” The answers provided by the presentation are: first, get rid of the noise; then stay away from the noise; and, finally, protect your ears. This approach engenders the concept that HPDs must be the last resort and may help to improve the hearing conservation climate in an organisation. The user is referred to the website and NIOSH for more information and for contact numbers and details of experts.

With regard to the criteria for evaluating the materials discussed earlier, the PowerPoint® presentation may provide opportunities for better controlling these five criteria. The particular presentation by NIOSH has little accessibility and relevance to the South African context. It is superior in its ability to enable and to motivate compliance, and in its presentation of care of HPDs.

5.2 NIHL simulator

The NIOSH Hearing Loss Simulator is a software training and communication tool for promoting hearing conservation. It allows a user or trainer to demonstrate the effects of noise exposure on hearing without experiencing an actual noise-induced hearing loss. Estimates of the effects of different levels of noise exposure are based on the *American National Standard Determination of Occupational Noise Exposure and Estimation of Noise-Induced Hearing Impairment* otherwise known as ANSI S3.44. This standard specifies the predicted hearing loss for noise-exposed populations of individuals on the basis of risk factors that include sex, age, exposure levels (in A-weighted decibels or dBA), and years of exposure.

The NIHL simulator includes various devices used to convey the impact of NIHL as discussed in the sub-sections below.

5.2.1. Instructive scenarios

The full power of the simulator is shown by working through some instructive scenarios. Some of the scenarios suggested are:

- **Older worker, noise exposed** – A hypothetical older worker is described. The program can simulate the range of 55 to 65 years old with 35 to 45 years of exposure

to 90-100 dBA. Selection of numbers in these ranges can depend on what is typical in the user's workplace or industry. The trainer can demonstrate the significant hearing loss this worker will have going into retirement.

- **Older worker, no exposure** – Immediately following a demonstration about a hypothetical noise-exposed older worker, the trainer can set the exposure years to zero and simulate an equivalent worker with no exposure. This will serve to counter any assumption that the first worker's hearing loss was a natural consequence of aging. Instead, users will see that a relatively small amount of high frequency loss is expected in older workers, but that noise exposure is responsible for much more of the damage.
- **Mid-career worker** – Especially if there are a large number of mid-career trainees, a worker with 10 to 20 years of exposure may be simulated. On the basis of this worker, several progressions can be followed. For instance, additional exposure years can be added to show the accumulation of more hearing loss. The noise simulator also allows comparison with an older non-noise-exposed worker, which then allows the trainer to make the point that, with enough exposure, a 30-year-old worker may have, in effect, 50-year-old ears.
- **Individualised** – The simulator can also be used as an individualised training and counselling tool. The trainer can show a worker how his/her hearing test results can be entered directly into the simulator. Using the frequency band sliders and selecting the "invert loss" function, the trainee can be given a hint of what his/her hearing would be like if the hearing loss had been avoided. Switching back to the original loss profile, the trainer can then drag the sliders down to show the additional loss that would occur after further noise exposure.

Another useful aspect of the simulator is the graphical display that shows the current instantaneous levels of sound across the frequency spectrum. This shows the relative amounts of low- and high-frequency sound in the recording; for example, for the female voice the high-frequency bars toward the right side of the graph will show higher peak levels than for the male voice. The display also demonstrates the loss of high-frequency information when a noise-induced hearing loss is simulated. This may not be relevant for all levels of education nor for all workplace requirements and would need to be included only when necessary.

5.2.2. Predicted loss on the basis of exposure

Prediction of hearing loss is based on the ANSI S3.44 standard. Parameters used in the prediction include

- **Effects of age** – Some hearing loss occurs as people age, but deafness or even a severe hearing loss is not inevitable. One of the major lessons to be learned from the simulator is that aging usually causes much less hearing loss than does noise exposure. The simulated individual's age in years can be entered to show how older people tend to have a gradual loss in the high frequencies, i.e. an older worker who has not been exposed to loud noise will typically have worse hearing at 8000 Hz than at any lower frequency.
- **Gender** – Males tend to have higher levels of hearing loss than females who have had the same noise exposure, so the program allows the user to specify the simulated worker's sex.
- **Years of exposure** – Time is the second major ingredient of exposure. This is set in years to represent a noisy period in the simulated individual's life. It can cover just a noisy portion of a career (e.g. ten years of working in a mill) or multiple noisy periods. The years represent working days, not continuous exposure.
- **Exposure level (dBA)** – As expected, high-intensity sound levels cause much more hearing damage than lower levels. The effect of different levels of noise can be simulated by entering the desired A-weighted sound level in decibels. The value represents an estimate of the average exposure over the simulated time period, commonly referred to as the "time-weighted average" (abbreviated as TWA).
- **Fractile (population distribution)** – Noise does not affect everyone to the same extent. To account for variations within the population, the ANSI S3.44 standard specifies expected hearing loss for different population fractiles. The program allows the user to specify the 0.1, 0.25, 0.5, 0.75 and 0.9 fractiles. For instance, a worker at the 0.1 fractile would have more hearing loss than 90 per cent of the equally exposed population. Those at the 0.75 fractile would have more hearing loss than just 25 per cent of the population. Most workers will have no way of knowing their susceptibility to noise, so this control should usually be set on the expected population median of 0.5.

5.2.3. Predictive impact on the basis of the listening environment

A “Speech and Noise Source” screen in the simulator takes into account the following aspects that will influence the impact of the hearing loss on the person’s quality of life:

- **Speech Source (foreground sound)** – Human speech is provided as both the most complex and important foreground sound most workers need to perceive. The trainer can choose either a male or female voice recording from the dropdown list.
- **Noise Source (background sound)** – Background sounds often severely tax a listener’s ability to hear and/or comprehend the intended message. The simulator allows the choice of several types of background sounds, including some recorded worksite sounds (continuous miner, haulage machine, drill) and some more generic standard background noises (male or female “speech babble”, white noise, etc.).
- **Speech-to-Noise Ratio** – The speech-to-noise ratio control affects the loudness of the background noise source relative to the foreground sound. This can be used to demonstrate how increasing background noise interferes more with understanding the foreground speech recording.

As can be seen from the description, this is a very powerful and versatile educational and motivational tool. When using the criteria for evaluation of this material it is apparent that the accessibility and relevance of this NIHL simulator would not be appropriate for the South African context while the enabling, motivational and technical criteria would be good. The strength of the NIHL simulator is that it is available free as a downloaded program from the NIOSH website and is very easy to use. The value of using the NIHL simulator as a pilot tool and then, in conjunction with NIOSH, adapting the program for the specific South African language and cultural environment is something that should be investigated for the longer-term impact of this project. A disadvantage of this type of individualised tool is that in an industry like the South African mining industry, with very large workforce numbers, the ability to provide individualised attention requires a large training and counselling staff. However, if the simulator was included in an e-learning environment this problem could be solved.

5.3 Viewmaster® programme “Wearing hearing protectors properly”

This novel format of training is also available from the NIOSH hearing loss prevention research group.

The 3-D slide reel viewer (Appendix A-1.5.) comprises a handheld picture-instruction slide reel plus an instruction booklet for the instructor. The reel is viewed by the trainee while the

instructor explains the process of properly inserting HPDs with the “roll-squeeze-push” three-step instruction.

This is a cheap format and easily used if the instructor is able to speak in the mother tongue of the trainee. The accessibility would therefore be good, as would the enabling value of this way of training. Currently, the slide reel only covers the training for the use of HPDs, but could be extended to include other aspects of hearing conservation. In this way, the relevance and motivational aspects could be covered in a similar way. The 3-D slide may be an alternative way to carry out re-training in a mining environment to ensure a novel way of catching a worker’s attention and for light and portable options.

5.4 Local self-developed courses

When no South African-specific results were found in Internet searches, hearing conservation practitioners were contacted as part of the research team’s investigation into what is being used in the industry. Anecdotal information seemed to indicate that in many cases, because of the lack of work-specific and context-specific material for hearing conservation, many practitioners had developed their own PowerPoint® presentations and lecture material. None of this material was available commercially nor was it standardised.

5.5 E-learning courses

It became clear from many aspects of information gathering in this project; namely, the analysis of the sales’ records, the focus groups, the host mine contacts, and the practitioner contacts, that particularly the large stakeholders in the industry had developed e-learning models for all the H&S topics, including hearing conservation. Multimedia technology such as the computer has the potential for standardising materials, outcomes’ measurements, and quality on an industry–wide basis and should be investigated for improved hearing conservation practice.

5.6 Posters

The multimedia assessment of educational and motivational material must include the use of posters since bombardment with information and subliminal transfer of information is a well-known method used in advertising and marketing. The availability of targeted topics in hearing conservation posters both internationally and nationally is very poor. Posters are also not available in all South African languages. This appears to be a very large gap in the tools available for hearing conservation practitioners.

5.7 Industrial theatre

If multimedia and newer technologies are to be used as an assessment of relevance of available material, industrial theatre must be included in the possible options. A number of local production companies with experience in other areas of H&S are available in South Africa but hearing conservation-specific scripts have not been created thus far and need more investigation. Video copies of relevant drama could be used for more affordable transfer of information.

6. Recommendations for the updating and enhancement of the GEN 011 materials

The results of the focus groups and personal interviews held at the three host mines, information gleaned from the current multimedia materials available locally and internationally, and the evaluations by the project team formed the basis of the recommendations for updating and enhancing the GEN 011 materials.

6.1 Video programme

Recommendations relating to the video were as follows:

- The video should be distributed in DVD format only
- The gold-platinum and coal versions should be consolidated into a single programme
- The sound track (English and Zulu) should be re-dubbed to improve the sound quality. This will entail replacing many of the narrator on-camera scenes with scenes/footage that have off-camera narration.
- Improved access by different language groups and for use in different acoustical environments should be provided
- Scenes/footage with female mineworkers should be included to improve relevance
- The old music should be updated to be more contemporary music
- Volume 2 of *Guidelines for Trainers* should be revised to correspond with the updated video programme
- An audio demonstration of hearing loss and its impact on speech intelligibility should be included into the video.

6.2 Booklets

Recommendations for updating the HPD booklet were as follows:

- Panels with female mineworkers should be included
- Some of the pictures of HPD types should be revised to ensure that they are representative of what is available and in common use

6.3 Distribution and application of the materials

Recommendations regarding the distribution and use of the materials were as follows:

- More effective promotion to raise practitioners' awareness of the materials' availability
- More effective and broad-based means of distribution
- Updated materials should be made available for incorporation into mines' computer-based e-learning programmes.

7 Evaluation of updated materials

The interim report made recommendation to the MHSC regarding changes to the GEN 011 materials. An extended budget for the recommended changes was agreed to and audio/ visual production specialists were subcontracted to effect the proposed changes to the video and booklet. Specialist translators were subcontracted to translate the English script for the video into Zulu, Southern Sotho and Xhosa. English and vernacular speaking voice-over artists were employed to read the translated scripts for recording in a professional sound studio. Copies of the updated materials were then provided to the subcontracted industrial sociologist for their evaluation at the three host mines.

Focus groups were convened at the same three host mines used in the initial evaluation, to evaluate the changes made and to compare the findings of the evaluations before and after the updates made to the materials.

The findings of the re-evaluations are compared to the original findings in the following sections.

7.1 Booklet

The revised SIM 05 05 01 booklets in English and Zulu were distributed to focus group members and their responses were measured using the same questionnaire as used for the

original GEN 011 booklets. Focus group members' receptiveness to the revised and original booklets is compared in Table 7.1.

Table 7.1

Comparison of focus groups' receptiveness towards the revised SIM 05 05 01 booklet and the original booklet from GEN 011

Receptiveness towards booklet		Platinum	Gold	Coal
GEN 011 booklet	**Positive**	97.0 %	100 %	97.4 %
	Neutral	1.5 %	0 %	2.6 %
	Negative	1.5 %	0 %	0 %
SIM 05 05 01 booklet	**Positive**	97.6 %	69.6 %	100 %
	Neutral	0 %	2.2 %	0 %
	Negative	2.4 %	28.3 %	0 %

As indicated in the table, focus group members' receptivity towards the revised SIM 05 05 01 booklet improved slightly compared with the original booklet from GEN 011, with the notable exception of the gold mine. Receptivity increased marginally from 97,0 to 97,6 per cent at the platinum mine and more substantially from 97 to 100 per cent at the colliery. However receptivity towards the revised booklet at the gold mine was 69,6 per cent compared with 100 per cent for the original GEN 011 booklet, a drop of 28,3 per cent. There are two possible explanations for this finding. Firstly, 15 per cent of one large group of contract workers at the gold mine were functionally illiterate. Secondly, unlike the GEN 011 booklets, the revised booklets were only available in English and Zulu and not in Fanakalo. It was also a concern among gold mine employees that the booklet had not been produced in South Sotho, the predominant language on that particular mine. This seems to indicate a need to produce the booklet in languages additional to English and Zulu.

7.2 Video programme

The revised SIM 05 05 01 video programmes were screened in the language preferred by the majority of focus group members and their responses were measured using the same questionnaire as used for the original GEN 011 video materials. Focus group members' responses regarding the revised and original are compared in Table 7.2a.

Table 7.2a

Focus group evaluations of the revised SIM 05 05 01 video compared with evaluations of original GEN 011 video

Evaluation of video		Platinum	Gold	Coal
GEN 011 video	**Positive**	87.7 %	83.8 %	100 %
	Neutral	3.1 %	13.5 %	0 %
	Negative	9.2 %	2.7 %	0 %
SIM 05 05 01 video	**Positive**	93.2 %	100 %	100 %
	Neutral	4.5 %	0 %	0 %
	Negative	2.3 %	0 %	0 %

Evaluations of the both original and revised video programmes by platinum mine focus groups indicated that that all members preferred the video to the booklet, with that preference increasing from 87,7 for the original materials to 93,2 per cent for the revised materials. At the gold mine, preference of the video over the booklet increased from 83,3 to 100 per cent. At the coal mine, the percentage of employees who preferred the video to the booklet was 100 per cent for both the original and the revised materials. Despite overall preference of the video over the booklet, evaluation results for the latter were favourable, suggesting that the booklet is useful in the education, motivation and training of mine employees for NIHL prevention.

Table 7.2b gives the results of focus group evaluations of the original and revised videos' effectiveness in encouraging the use of hearing protection. It indicates that focus group members at all three mines found the revised video to be more effective in encouraging the use of hearing protection than the original programme. It was also found to be more effective than the original video in explaining the importance of protecting one' hearing and the consequences of failing to do so by all focus group members at all three mines, with no neutral or disagreeing responses. In general, the video medium was deemed a more powerful form of communication, particularly by gold mine focus groups that included a substantial number of illiterate individuals. This finding was the same, regardless of which language version of the video was screened, indicating that its visual content serves to overcome language barriers. Concerning the video's effectiveness teaching miners how to look after their HPDs, one per cent of all focus group members found the original GEN 011 video to be ineffective, while all focus group members at all thee mines found the revised video to be effective in this regard.

Table 7.2b

Comparison of original and revised videos' effectiveness in encouraging the use of hearing protection

The video is effective in encouraging the use of HPDs		Platinum	Gold	Coal
GEN 011 video	**Agree**	95.2%	97.2%	94.7%
	Disagree	4.8%	2.8%	5.3%
SIM 05 05 01 video	**Agree**	97.7%	100%	96.4%
	Disagree	2.3%	0%	3.6%

7.2.1 Prior knowledge and awareness

In order to assess general knowledge of hearing conservation matters and the noise hazard, focus group members were challenged with the suggestion that the video had not taught them anything that they did not already know. The number of focus group members who disagreed with the statement (i.e. indicated that the video did, in fact, provide them with new knowledge or information) increased from 40 per cent for the GEN 011 video to 48 per cent for the new video at the platinum mine; from 34 to 42 per cent at the gold mine, and from 57 to 66 per cent at the colliery.

7.2.2 Technical explanations provided by the video

The animation sequences in the updated SIM 05 05 01 video were deemed more effective in demonstrating how HPDs prevent damage to the ears than the original GEN 011 video. At the platinum positive responses in this regard increased from 52 to 86 per cent, from 46 to 64 per cent at the gold mine, and from 46 to 55 per cent at the colliery. Overall, the clarity with which the function of the ear was depicted in the updated SIM 05 05 01 was found to be good by 98 per cent of focus group members at the platinum mine, 91 per cent at the gold mine and 1001 per cent at the colliery.

7.2.3 Effectiveness of video compared with other communication media

Table 7.2.3 clearly shows a greater preference of the updated video over the booklet than was found for the original materials. Preference of the video at the platinum mine increased from 78,5 for the GEN 011 video to 92,7 per cent for the updated programme; from 82,4 to 97,8 per cent at the gold mine, and from 82,5 to 100 per cent at the colliery an overall increase in preference of the video from 80 to 96 per cent.

Table 7.2.3

Preference of video over the booklet for GEN 011 and SIM 05 05 01 materials

Preference of video over booklet		Platinum	Gold	Coal
GEN 011 material	**Agree**	78.5%	82.4%	82.5%
	Neutral	10.8%	5.9%	5.0%
	Disagree	10.8%	11.8%	12.5%
SIM 05 05 01 material	**Agree**	92.7%	97.8%	100%
	Neutral	2.4%	0%	0%
	Disagree	4.9%	2.2%	0%

7.2.4 Use of case studies and interviews for motivation

Evaluations of the video material considered the usefulness of interviews or case studies that were incorporated into the programme. The findings for the original GEN 011 and the updated SIM 05 05 01 programmes are compared in Table 7.2.4.

Table 7.2.4

Effectiveness of video interviews/case studies in the GEN 011 and SIM 05 05 01 videos in promoting positive attitudes towards hearing conservation

Use of interviews/case studies to promote hearing conservation		Platinum	Gold	Coal
GEN 011 material	**Effective**	95.2%	51.4%	100%
	Neutral	3.0%	45.9%	0%
	Ineffective	1.5%	2.7%	0%
SIM 05 05 01 material	**Effective**	100%	93.8%	100%
	Neutral	0%	2.1%	0%
	Ineffective	0%	4.2%	0%

During evaluations of the original GEN 011 video it was stated by some focus group members that the suffering of noise-impaired people “should have been more prominent”. The interviews with the wife and child of a hearing impaired man and hearing-impaired mineworkers in the updated video were found to be more effective than in the original version in promoting positive attitudes towards hearing conservation. The number of focus group members who found the interviews effective in this regard increased at the gold mine from 51,4 for the GEN 011 video to 93,8 per cent for the SIM 05 05 01 video; from 95,5 to 100 per cent at the platinum mine, and was unchanged at 100 per cent among colliery focus group members.

8. Updated HPD selection tables

GEN 011 (Franz, van Rensburg, Marx, Murray-Smith, Hodgson, 1997) measured the personal noise exposure levels for different occupations and determined the frequency spectra for various noise sources in coal, gold and platinum mining. The findings were used to develop HPD selection tables for various occupations and workplaces. The HPDs that were included in the selection tables were those available in South Africa in the mid-1990s. In order to make the NIHL prevention tools available to the mining industry relevant and up-to-date, the MHSC included the updating of this valuable HPD selection tool as an output of the SIM 05 05 01 Prevention of NIHL prevention Track C programme.

The project team used the NIOSH Hearing Protection Device Compendium as the basis for updating the previous HPD selection tables. Of the 292 HPDs in the NIOSH compendium, 97 are available in South Africa. Attenuation data for these were sourced from manufacturer websites and local agents for inclusion in the updated HPD selection tables for 2009.

The frequency-specific attenuation data supplied by HPD manufacturers and suppliers were incorporated into the updated selection tables. The HPD selection tables were further updated by formatting them into user-friendly Excel® based workbooks each of which includes various occupations for a given type of mining operation. The tables, which are available on CD, indicate:

- The expected noise-exposure levels as measured by GEN 011;
- The average effective attenuation for each available HPD;
- The effective noise exposure level (with HPDs) for users of various HPDs and whether or not the effective level exceeds the OEL (85dBA); and
- Whether or not the device's attenuation is likely to interfere with speech communication as a result of overprotection.

The tool includes:

1. A tabulation of 97 HPDs currently available in South Africa, with tables indicating the measured and expected attenuation, the latter with consideration to measured standard deviations;
2. Guidelines for the use of the HPD selection tables;

3. HPD Selection tables for various occupations and workplaces in gold, platinum and coal mining.

8.1 Guidelines for use of HPD selection tables

Table A-1 on the CD contains frequency-specific mean attenuation and standard deviation values supplied by the HPD manufacturers/suppliers, or their promotional literature, or sourced from manufacturer websites.

Each of the HPD selection tables in workbooks B to F on the CD relates to a specific occupation or workplace in coal, gold and platinum mining. Along the top row of each table is a summary of personal noise dosimetry results for the occupation or workplace being considered as measured by the GEN 011 project. This summary includes mean, maximum and minimum values for exposure levels (L_{avg}) and the number of samples from which the values were derived. In instances where no dosimetry was performed the table includes calculated L_{avg} values.

Below each column heading for centre frequency, in the row labelled *"without* HPD", is the mean value for A-weighted exposure level (L_{pA}) determined for that octave band. These are the sound pressure levels to which unprotected workers in that occupation or workplace are likely to be exposed.

In the second-to-last column (labelled L_{Aeq}), along the row labelled *"without* HPD", is the mean equivalent continuous A-weighted sound pressure level for the occupation or workplace being considered, calculated from L_{pA} values at the various centre frequencies. In the last column (labelled L_{avg}), along the same row, is the expected equivalent noise exposure for unprotected employees, based on the dosimetry-derived (or calculated) L_{avg} rounded to the nearest integer.

The subsequent rows show the effective L_{pA}, L_{Aeq} and L_{avg} values calculated for users of a given HPD. To determine the expected attenuation at each centre frequency, the mean attenuation (from Table A-1) was reduced by one standard deviation unit in the case of if the HPDs were earmuffs or custom moulded earplugs, or by two standard deviation units in the case of off-the-shelf earplugs. Two standard deviation units were subtracted rather than one, in order to avoid overestimating the level of protection.

Where the manufacturer provided attenuation dat for 3150 Hz 6300 Hz these values were included in the selection tables. The L_{pA} at each frequency for unprotected workers was then reduced by the value of corresponding expected attenuation, resulting in the effective L_{pA}.

Effective L_{pA} values at the various centre frequencies were logarithmically summed to determine the effective L_{Aeq} for users of the HPD being considered.

The reduction in L_{Aeq} provided by the HPD (L_{Aeq} without HPD minus L_{Aeq} with the HPD being considered) will result in a similar reduction in L_{avg}. The same reduction as calculated for L_{Aeq} has been applied to the value for L_{avg} without HPD, to determine effective average L_{avg} for employees wearing the HPD being considered. This value is displayed in the last column of each row, rounded to the nearest integer. Where effective L_{avg} exceeds 85 dBA, an indication is given that the particular HPD is inadequate for the occupation or workplace being considered, by the value being displayed as >nn<. Where effective L_{avg} is less than 70 dBA, the value is displayed as ((nn)) indicating that the HPD may overprotect and interfere with communication.

The attenuation characteristics of HPDs listed in Table A-1 and applied in subsequent HPD selection tables were obtained directly from manufacturers/suppliers or their promotional literature. The attenuation characteristics were all documented as having been determined in accordance with one or more standards, some of which, as stated above, provide a more realistic indication than others of the level of protection that can be expected. These tabulations should not be interpreted as indicating that a particular HPD "passes" or "fails". They are, however, intended to provide a means of comparing the suitability of the various HPDs for an employee in a particular occupation. Devices that do not provide sufficient attenuation for an extreme noise source may well be suitable for more moderate applications and, in such cases, would be more appropriate than higher attenuation devices. Where an HPD indicates potential overprotection for a particular occupation, again this does not indicate that the HPD is unsuitable for all occupations but rather that speech understanding will be reduced when wearing the HPD in question.

9. Recommendations

The request for additional language versions of the HPD training booklet voiced among focus group members at the gold mine appears to indicate a need to provide the booklet into the same two additional languages as requested for the video materials, i.e. South Sotho and Xhosa. To reproduce/print large quantities for distribution within the mining industry, it is recommended that MHSC engage the services of the concern that printed the limited numbers used for on-mine evaluations, or printers of their choice. The electronic files for the booklet, originally produced in Corel Draw® and converted to pdf-format for printing, are included on the CD with this report, the guidelines for trainers and the HPD selection tables.

With regard to the video materials, the DVDs on which they were recorded and submitted to MHSC are not encrypted or copy-protected in any way, to facilitate duplication. As for the HPD training booklet, it is recommended that MHSC engage a suitable duplication house to provide sufficient copies for distribution to the mining industry.

The updated awareness and training materials and HPD selection tools produced for SIM 05 05 01 Track C should not go underutilised, as was found to be the case for the original GEN 011 materials. Accordingly, the final recommendation of the March 2008 interim report is reiterated here, i.e. that the materials be promoted to raise practitioners' awareness of their availability (e.g. industry-specific magazines and journals and the MHSC website) and that appropriate means of distribution be used to ensure that the updated materials are implemented. With regard to promoting awareness of the materials and facilitating their use, it is recommended that consideration be given to the convening of workshops at major mining centres, aimed at Training, Occupational Health and Occupational Hygiene practitioners and that copies of the materials be distributed to workshop participants.

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Appendices

A-1.1 Questionnaire used to conduct personal and telephonic interviews with users of materials from GEN 011

SIM 05 05 01
Interview Questionnaire
Evaluation of GEN 011 hearing conservation training materials

1) Details of person interviewed:

Name: _____

Designation: _____

Company:_____

Contact number:_____

Email: _____

Date: _____

2) What is the main commodity produced by your company? _____

3) According to our records, your company ordered hearing conservation educational and training materials comprising the video programme "To hear or not to hear", with Guidelines for trainers and overhead transparencies and/or the training booklet, "Make Safe Your Ears". These materials:

- Are still in use ☐
- Are no longer in use ☐
- Have never been used ☐

4) Has your company used other commercially available educational/training materials?

- YES ☐
- NO ☐

4a) If YES, please describe the materials and indicate where they were purchased.

_____
_____
_____
_____

5) If NO, what educational/training materials or learning aids/activities does your company use to promote hearing conservation among employees?

_____
_____
_____
_____

6) Do you or have you ever utilise any of the following and did you find them useful?

	Utilised	Useful	Not useful
Video, 'To hear or not to hear: The choice is yours', Parts 1 & 2	☐	☐	☐
Guidelines for Trainers	☐	☐	☐
Overhead transparencies	☐	☐	☐
Handout for Trainees/Training Booklet 'Make Safe Your Ears'	☐	☐	☐

Comments:

_____
_____
_____
_____

7) Do you have any suggestions for improving the usefulness of these materials?

_____
_____
_____
_____

8) Do you have any suggestions for how any of these materials could be made more effective?

_____
_____
_____

9) How relevant are these materials to employees at various levels?

	Relevant	Partially relevant	Irrelevant
Unskilled/Semiskilled	☐	☐	☐
Supervisors	☐	☐	☐
Management	☐	☐	☐

10) Do you have any suggestions for how these materials could be made more relevant to any of the various levels of employees? (Probe “Partly relevant” and “irrelevant” responses)

_____

_____

_____

11) Invitation to participate in focus group:

We are attempting to understand the influences of human and organisational culture, level of education, language and other factors on the usefulness and effectiveness of the hearing conservation educational and training materials developed for SIMRAC GEN 011. Would your company consider the participation of its employees in confidential interviews focus groups and to discuss and evaluate these materials?

Thank you so much for your valuable time and useful input!

A-1.2 Specimen of letter requesting permission to conduct employee interviews and focus groups at host mines, in order to evaluate materials from GEN 011

NRE: Occupational Health & Ergonomics
PO Box 91230 Auckland Park 2006 South Africa
Tel: +27 11 358-0000
Fax: +27 11 482-3267
Email: query@csir.co.za

7 December 2007

Reference: SIM 05 05 01 Track C/YHC0024-1

The Manager and Head of Operations
(Name of mine)

(Postal address of mine)

(Postal code of mine)

Attention: (name of prospective champion/liaison officer)

Dear Sir

REQUEST FOR ASSISTANCE WITH SIM 05 05 01, NIHL PREVENTION TRACK C

CSIR has been awarded the abovementioned research project by the Mine Health and Safety Council. Among the project's primary outputs are updated and enhanced educational, training, motivational and awareness materials, based on those developed for GEN 011 (Enhance the effectiveness of existing hearing conservation programmes). Our approach will be to convene focus groups and conduct in-depth interviews involving all levels of employees and key personnel at three host mines, to evaluate the existing materials in terms of their usefulness in mine hearing conservation programmes and their impact on the attitude and behaviour of mineworkers. The findings will then be used to revise and enhance those materials.

We have requested assistance from two other mines, a (type of mine and a (type of mine) and, after discussing our needs with (name of prospective champion), are requesting permission to obtain input from (name of mine) personnel in the evaluation of existing materials. If you are in a position to assist, we would like to begin in mid-January 2008, by conducting focus groups and interviews involving all levels of (name of mine) employees, including key personnel. The

purpose will be to examine, discuss and evaluate the existing materials, and identify aspects for improvement.

We have engaged the services of Paul Stewart, an Industrial Sociologist from the University of the Witwatersrand who has extensive experience in the mining industry as a researcher and consultant dealing with issues relating to organisational culture. His intention is to spend two to three days at (name of mine) facilitating discussions and interviews with focus group and interview participants. His findings at the three mines will inform decisions on the revisions and enhancements to be made, after which we would like to repeat the evaluation process for the revised materials during the month of June 2008.

If you are in a position to assist us we would be most appreciative and assure you that we will respect the confidentiality of (name of mine) and its individual employees, i.e. the names of the mine and mine employees will not appear in our reports to MHSC. We will also provide feedback to you on the project's findings.

Thank you for your consideration in this matter and we look forward to your response.

Yours faithfully,

RM Franz
Occupational Health & Ergonomics

D Vogt
Manager: NRE Mining

A-1.3 PowerPoint® presentation explaining purpose of focus groups at host mines in order to evaluate materials from GEN 011

GEN 011 is made up of:

1. Training VHS:
   "To hear or not to hear...the choice is yours!".

- Later converted to CD
- Gold/Platinum version
- Coal version
- English version
- Zulu version
- Part 1: Awareness-15 min.
- Part 2: Training-10 min.

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GEN 011 is made up of:

2. Booklet “Make safe your ears”.

- English version
- Zulu version
- Fanakalo version
- Black and white printing
- Comic style
- A5 landscape format

GEN 011 is made up of:

3.Guidelines for Trainers

Part 1: Hearing Protection devices: Induction talk for employees in noisy occupations

- to be presented immediately before Audiometric Testing

Part 2: Use of training video

- pre- and post-viewing discussion for Educational/Motivational module and HPD module

Part 3: Typical concerns raised by individuals resistant to using hearing protection devices

- Two overhead transparencies

Part 4: Use of the handout for trainees: “Make safe your ears”

Survey of purchasers

- Telephonic
- Interview
- Identified potential hosts for focus groups

Focus groups

- Present existing materials to Focus Groups representing all levels of mine employees and including key personnel, to elicit their views as to the applicability, perceived relevance and effectiveness of the materials in encouraging mineworkers' commitment to hearing conservation.
- All sessions to be conducted on surface at Training Centers or offices. A flexible strategy will be employed regarding numbers of participants in Focus Groups dependent on people's availability.

Focus groups

- Time frame
  - **1. Individual interviews with management:**
    - Mine Manager – ½ hour
    - Production Manager – ¾ hour
    - Health and Safety/SHE manager (as applicable) – 1 hour
    - Mine overseers – combined (Small focus group – 3-5 persons) or individually – 1 hour
  - **2. Focus Group sessions with employees:**
    - 3 - 5 Shift supervisors/Miners - 1hr
    - 5 - 8 Team Leaders - 1 hr
    - 8 - 12 UG workers - 1 hr
  - **3. Other Role players – informal discussions**
    - Training Officers
    - Trade union representatives
    - Health & Safety Representatives (where applicable)

Focus groups

- Requirements
  - Venue with chairs and table for group discussions led by our facilitator
  - Facilities for viewing the CD/DVD
  - Light refreshments

- Evaluate-by means of analysis of the discussion and responses
  - Language influences
  - Culture influences
  - Educational influences
  - User influences
  - Motivational influences

Not looking at the method or policy used on any mine
Not looking at individual's knowledge or awareness


Thank you.
Questions?
CSIR
our future through science

A-1.4 Questionnaire used for focus group discussions

Council for Scientific and Industrial Research
SIM050501 Evaluation of hearing conservation materials

We are researchers from the CSIR and have been asked to request your assistance in exploring ways to improve the awareness training materials to reduce noise induced hearing loss. Your assistance in this regard is very important and your free participation is gratefully received. No names of persons or mines are noted. Your answers are completely anonymous. You may decline to respond to any statement. Please say whether you agree, strongly agree, disagree, strongly disagree or are neutral regarding the following few statements. Thank you for participating.

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. I am happy to read the booklet and see the video on NIHL in English, Fanakalo or Zulu.					
2. The video I saw in the training centre and/or the booklet makes me understand why I should wear my ear plugs/HPD's					
3. My training was good and effective in teaching me to look after my earplugs/HPD's					
4. Training videos and booklets help me understand why it is important for me to protect my hearing.					
5. This training makes me think what it would be like not to hear.					
6. After watching the video I want to make sure I do not go deaf.					
7. I admit I do not use my ear plugs every time I am in a noisy place at work even though I know about the danger of hearing loss					
8. The pictures in the video/booklet help me to remind me about the dangers of NIHL and the importance of using my ear plugs/HPD's					
9. The drawings of the inside of the ear showed clearly how to put in ear plugs/HPD's properly and prevent damage to my ears.					
10. The words of the deaf man's wife Octavia and her child made me think again about being more careful when there is noise where I work.					
11. The pictures of the workplace are the most interesting of the whole video.					
12. There should be more stories of					

people who have suffered from hearing loss.					
13. The video did not teach me anything I did not know.					
14. The sound in the video should be improved.					
15. I find the video informative and educational.					
16. Training such as video and booklets does encourage people to wear earplugs/HPD's					
17. Many people I work with ignore training about hearing conservation.					
18. There is nothing you can do if people don't listen to the hearing conservation training and don't wear their ear plugs.					
19. The video should show deaf workers who have lost their jobs like the guy begging on the street with a notice board.					
20. People are more aware now of the dangers of noise for hearing loss than before.					
21. Most people do wear their earplugs/HPD's					
22. Some people don't wear their ear plugs/HPD's because they want to get compensation money.					
23. The best way to make people comply is to charge them.					
24. The best way to make people comply is to talk to them and teach them.					

A-1.5 Viewmaster®